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ABSTRACT

The author explores the utility of educational games in elementary and secondary social studies classes. Separate sections of the paper discuss types of games, similarities among formal games and social studies topics, educational game design, and examples, advantages, and limitations of educational games. Game playing in society is described as either formal or informal; formal games comprise three categories: showdown, strategy, and a combination of the two. A table of social studies topics which include the subject areas of history, geography, civics, and economics that can be broken down into elements common to formal games is presented. Next, the process of game design is explained in three steps: system analysis, simulation design, and refinement. System analysis defines the major actors in a process, their interactions, and their decision rules in responding to each others' actions. Following the discussion of game design, eight examples of educational games relevant to social studies and designed by the author are briefly described. The final section notes several advantages of games in the classroom setting: they present concrete problems in a simplified but dramatic form; the attention span of elementary school children is increased; the player gains a growing sense of structure among the game variables; and the games which simulate reality can present the great problems of contemporary society on a level of specific human action that directly relates the student's decisions to the larger world. Disadvantages are discussed in terms of teacher attitudes and the attractiveness of games to children. (KC)

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Occasional Paper No. 7

Games for Learning

BY

CLARK C. ABT

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The Social Studies Curriculum Program

Educational Services Incorporated

Introduction

Among the many new devices which are being developed for the purpose of motivating children to learn and of increasing their ability to learn, one of the most interesting is that of teaching games. The notion that children can learn by playing is not, of course, new; young children obviously do a great deal of learning in this fashion. Less frequently, however, do we think of games as teaching devices for secondary school classrooms; there we are accustomed to expect activities that are formal, stiff, and not "fun."

In GAMES FOR LEARNING *Dr. Clark Abt explores both the theory behind using teaching games and discusses some particular games which he designed for the Social Studies Curriculum Program of Educational Services Incorporated. Dr. Abt received his B.S. in engineering and his doctorate in political science at the Massachusetts Institute of Technology. After several years with the Raytheon Company, as manager of the Advanced Systems and Strategic Studies Departments, he founded and became the president of Abt Associates Inc., a research firm specializing in the combination of social sciences, operations research, computer model simulation, and systems engineering.*

PETER WOLFF
Editorial Director

April, 1966

Games for Learning

by Clark C. Abt

Some problems of teaching social studies in elementary and secondary schools

Social studies, as they are taught in most secondary schools today, generally consist of geography, history, "civics," and sometimes economics. From the aspects of analytic precision and comprehensive scope, these subjects are closer to the humanities (if indeed history is not considered such) than they are to the sciences. There are no elegantly simple rules of behavior in social studies, because they deal with animate individuals in societies, rather than with the inanimate material objects of mathematics, physics, and chemistry. There usually are no formulae to be remembered, no theoretical calculations to be made, and no experiments to be executed and observed in secondary school social studies classes.

If learning is based on experience and drawing analogies to previous experiences, it seems clear why the effective teaching of social studies is most difficult when only conventional techniques are used. In English, mathematics, physics, and chemistry, there are frequent situations where the child can learn by doing, such as listening and talking, reading and writing, problem solving, and experimenting. Similar situations are not usually available to the teaching of social studies because there are no opportunities for students to make history, write history, solve problems of global geography and economics, or experiment with forms of civic organization.

In conventional secondary school social studies, the students may not learn as much or as deeply as in other subjects, because they cannot readily learn to be surprised at things without having some experience of how they ought to be. They cannot learn that they have made mistakes unless they can make mistakes—and making a mistake in history means making a wrong decision, not failing to remember a date.

The relatively greater difficulty of teaching secondary school social studies seems particularly regrettable today, when the do-

mestic and international socio-political issues need to be understood by all citizens. Furthermore, the individual high school student needs all the social studies information he can get to help him in his choice of career and higher education. For the many high school students who do not go on to college, social studies offer the only over-all view of our society, our culture, and our civilization—an over-all understanding that is important for the unity of our country and the fullest possible development of the individual. It therefore seems useful to develop improved techniques for teaching social studies in secondary schools. Heuristic games constitute one such technique that improves student understanding of social studies, by means of the well-established devices of conditioning through doing and analogizing to the students' previous experiences.

Similarities among formal games and social studies topics

Games are most familiar as amusements and sports, but they are not necessarily only amusing or even sporting. For the professional athlete or gambler, games are a completely serious matter. For the players of political games, such as "I Will Not Be A Candidate" and "Consensus Building," they can be matters of political life and death. For the players of corporate games such as "My Ambitions Are All For The Firm" and "Expanding Markets," they can be matters of a company's life and death. For the players of romantic games such as "If I Ignore You Maybe You'll Notice Me" (also known as "Hard To Get") and "Hidden Depths," they can be matters of emotional life and death. For the players of marriage games such as "You Made Me Do It" and "I Can't Understand You," they can be matters of a marriage's life and death. For the players of crime games such as "Getting Even" and "Then They'll Respect Me," they can be matters of personal life and death. And for the players of political-military war games such as "Getting In The First Strike" (also known as "Defensive Preemption") and "My Last Offer" (also known as "Controlling The Escalation"), they may be matters of a nation's life and death. In sum, many games are very serious indeed.[1]

Why are these groups of events games? Why are careers sometimes called the "advertising game," or the "teaching game"?

[1] For other examples of serious games, see Eric Berne, *Games People Play*, 1964; and Anatol Rapaport, *Fights, Games, and Debates*, 1962.

Why are certain types of personal behavior called "that old game"? These are games because they all contain the basic elements of games. A trial of abilities is a test. When more than one person is tested and the results are compared, we have a contest. A game may be defined as any contest (play) among adversaries (players) operating under constraints (rules) for an objective (winning, victory or payoff). Mathematical game theory defines games in terms of the number of independent players, the degree of competition and cooperation among them, the amount of information they have about their adversaries, and whether the game is deterministic or probabilistic.

Whether games are defined as contests played according to rules with power resources, skill, and luck; or as mathematical exercises,[2] they always have the characteristics of *reciprocal actions and reactions* among at least partly *independent entities* having *different objectives.*

In "I Will Not Be A Candidate," for example, the reporter acts by asking questions of the potential candidate intended to exact a commitment from him to the role of candidate. The reporter's objectives may be both professional and political: the achievement of a "scoop," and the "flushing out" of disavowed intent. The potential candidate reacts with various forms of the statement, "I will not be a candidate," strongly implying, however, that he is certainly considering becoming a candidate and would like to be asked the question again. The potential candidate's objectives are to continue to be asked if he will run so as to gain publicity by building up suspense, while at the same time avoiding the loss of political bargaining power incurred by a premature declaration of intent.

This is a partly cooperative game (a game with a non-zero sum), but it also has partly competitive objectives for the two players.[3] They can both lose if the reporter stops asking too soon or the candidate announces too late, and they can both win if the reporter asks just long enough for the candidate to announce his candidacy. The reporter "wins" most if he can trick the candidate

[2] See for example, Von Neumann and Morgenstern, *The Theory of Games and Economic Behavior,* 1944; J. D. Williams, *The Compleat Strategist,* 1954; Melvin Dresher, *Games of Strategy,* 1961; Luce & Raiffa, *Games and Decisions,* 1957.

[3] In mathematical game theory "zero sum" means that the arithmetic sum of the payoffs to the players is always zero—that is, if one player wins all (+1), the other loses all (—1).

into announcing slightly prematurely, when the news values of novelty and significance are maximized. The candidate may then lose a little of his preferred timing for the announcement. The candidate "wins" most if he can get the reporter to keep asking, but announces only when it best suits his political purposes. By that time the announcement may not come wholly as a surprise, and the reporter will have lost some of his "scoop."

Games such as this are examples of informal games, because their rules are implicit rather than explicit. Formal games, on the other hand, have at least some explicit rules, although there are usually additional implicit rules involved. Formal games may be classified according to three major types: *Showdown* games, in which each player exhibits his best physical or mental performance and luck without interference from any other player, and the results are compared; *Strategy* games, in which opposed players interfere with each others' exhibited performances; and *Combination* games incorporating strategic exchanges preliminary to showdowns. In each of these categories, the substance of the game may consist of various combinations of skill, chance, realism, and fantasy.

Examples of formal *showdown* games are poker, craps, treasure hunts, charades, most races, and golf. (Informal showdown games are "Getting Even" or competitive secret bidding on jobs.) Examples of formal *strategy* games are bridge, chess, checkers, ghosts, boxing, and wrestling. (An informal strategy game is "Hard To Get.") Examples of formal combinations of strategy and showdown (racing) games are football and hockey.

Among animals, most games are of the informal strategic type, although the mating displays of birds are showdowns. Many games may have originated as youthful efforts to imitate adult activities, or as religious rites preceding military struggles (invoking the gods controlling "chance"). It is in the examination of game origins that we return full circle to the relation between formal games and social studies.

The ancient priests who first formulated the predecessors of some familiar games of skill and luck sought a symbolic isomorphism between some critical elements of large scale historical developments such as wars and social conflicts, and their religious ceremonies. If their magical skills could demonstrate power over the ceremonial analog of the dread historical crisis, then it would

seem to many seekers after certainty that these same magical skills might control—or propitiate—the real world crisis. Many of these serious religious rituals are still played today by primitive peoples. They resemble games in their formal simulation or modeling of larger processes, but differ from games in the asymmetry of power among the players (men and gods) and the greater certainty of a formal outcome.

Another kind of relatively primitive people—children—also seek comprehension of and power over larger-scale adult activities by playing mimetic games or role plays such as "Doll House" and "Soldier."[4] Children incorporate and organize much perceived adult behavior by playing the role of adults, and games seem to be one of the fundamental means by which children learn about the larger world outside. What could be more natural, then, than to continue the play-learning process in the schools? It would exploit a behavioral mode toward which children are already strongly motivated, and by the use of which they have repeatedly demonstrated impressive learning performances.

Given the desirability of teaching with games, is it feasible? Specifically, is there enough similarity between social studies topics and games that can be played effectively in high school classrooms? We think so. Consider the table of social studies topics on p. 8, and how they can be decomposed into play elements that are common to formal games.

In addition to the sometimes surprising similarities between the structure and dynamics of social studies topics and formal games, there are the well known similarities between group military conflicts and the classical "war games" of chess, checkers, go, etc. These similarities are not accidental; the games were probably originated by military practitioners for their part-amusement, part-training. Variations of these games of military strategy share many common elements with those social studies topics dealing with military or military-like conflicts, such as wars, revolutions, insurgencies, price wars, industrial and class conflicts, elections, etc. These similarities have been found sufficiently valid to have provided generations of military careerists with diversion and perhaps some indirect instruction in such basic military principles as the offensive, concentration of forces, mobility, reconnaissance, etc.

[4] Role plays differ from games in that the former have more determined outcomes and may not be competitive.

Social Studies		Elements Common to Social Studies and to Games			Formal Games	
Subject	**Topic**	**Players**	**Objectives**	**Typical Resources**	**Example**	**Type**
History	Civil War	Loyalists vs. Rebels in Civil War	Gain support of neutrals	Coercion and persuasion		Strategy
		High, low vs. middle in High-low poker	Gain support of opposite	Sequence and betting	High-low poker (2 winners)	
	Colonization	Colonizers vs. Colonizers	Control colonial region	Power, decision, speed		Showdown
		Climbers vs. Climbers	Control "mountain"	Power, decision, speed	King of the Mountain	
Geography	Raw Materials Production	Producer vs. Producer	Capture market	Location closest to market		Strategy
		Player vs. Player	Capture ball	Closest to ball	Soccer	
	Trade Routes	Civilization vs. Geography	Get closest to market	Mobility		Showdown
		Players vs. Position	Get closest to objective	Movement	Shuffleboard	
Civics	Legislative Processes	Elected reps. vs. Elected reps.	Vote or kill legislation in spite of blocks	Numbers, organization and timing		Strategy
		Players	Score goals, deny opponents goals	Mobility, specialization, cooperation	Basketball, Football	
	Elections	Candidates vs. Candidates	Win	Outdistancing opponents		Showdown
		Racers vs. Racers	Win	Run faster	Races	
Economics	Union-Management Collective Bargaining	Union vs. Management	Increased share of profits	Strike-lockout		Strategy
		Teams	Goals	Massed power	Rugby	
	Competitive Investment	Investors vs. Investors	Profit	Capital, calculation		Showdown
		Players	'Play' profit	Capital, calculation	Monopoly	

Although there are many similarities between familiar formal games and elements of social science topics, there are also some important differences. Most games provide for a uniformity of initial player resources—in real life it is seldom so. Most games have fixed uniform rules clearly known by the players. In real life, the rules of the "games" are continually (although often slowly) modified by the players, and there is often a game over the nature of the rules themselves (sometimes called "Legislature" or "Supreme Court"). Real life "rules," or constraints on behavior, are often tacit rather than explicit, and sometimes not even completely known to the players.

Perhaps the greatest difference between traditional formal games and real life "games" is that the formal games are mostly pure competitions—that is, they usually have only one winner, and all the winner's adversaries are losers. Most formal games thus most closely resemble the bitterly competitive power struggles of wars, revolutions, and intense political and economic combats. Obviously most political, economic, and social processes are at least partly cooperative, and many are almost wholly cooperative. In cooperative processes, all the "players" (participants) "win," although perhaps in different degrees. Formal games rarely simulate this common aspect of our experience, being usually oriented toward conflict. Only to the extent that the loser of a formal game who cooperates in playing "wins" the pleasure of playing, do formal games also represent the mutual benefits of cooperative activities.

Some recently developed formal parlor games have introduced cooperative activities specifically intended to simulate partly cooperative historical activities such as international alliance-forming. Cooperation of course exists in formal card games such as bridge, but it is abstract and does not refer to a specific historical situation. Recently a number of educational games have been designed that involve realistically cooperative behavior. Some of these are described later in this paper.

An elementary theory of educational game design

The design of educational games is different from that of games designed primarily for entertainment, although their forms may be similar. An educational game's objective is to educate, not to entertain. Entertainment becomes an instrumental value, rather

than the design objective. In entertainment games it is just the opposite; for achieving the maximum of entertainment, the players must be "educated" in the game's possibilities.

The following educational game design procedure constitutes a kind of elementary theory, much of which remains to be verified by observation of experimental games. It consists generally of a *system analysis* of the substantive problem, process, or situation to be taught; the design of a *logical or mathematical model* that is a simplified manipulable analog of the process or problem to be taught; the *design of a human player simulation* of the model; and the *refinement* of both the original system analysis and abstract model through repeated test plays of the game.

System Analysis: The educational objectives of the game are specified in terms of substantive scope, structural comprehension, factual detail, and relationship to other educational material. The educational objectives are used to limit the situation or process to be analyzed in time, geographic area, and functional scope and detail. This time-area-function-bounded "problem space" is then subjected to a system analysis. The system analysis generally consists of identifying all the major decision-making entities, their material and information inputs and outputs, and the resources and information exchanged by these decision-making elements. Typical decision-making entities are government institutions, political leaders, and participating publics in political history models; individual hunters, families, and tribal leaders in anthropological models; and producers, consumers, entrepreneurs, and traders in economic models.

A sequential analysis is then made to determine the sequence and rate of flow of information and resources among the decision-making entities that have been identified. The flow of information and resources in most political, economic, social, and natural systems is usually largely cyclical. If it is completely cyclical, we have what is called a "closed" or "conservative" system or cycle, in which the total amount of whatever flows through it is a constant quantity, more of it in one place resulting in less of it in another. Over a short period of time, material or resource flow is usually in the form of a closed cycle because it is mostly the distribution rather than the total quantity that changes. The flow of information is more complex, since it is not "consumed" so much as it is withheld, lost, modified, or distorted. The sequential

analysis determines the information and resource inputs to and outputs from each of the decision-making entities.

Analytic Model: A decision-analysis is now made of the decision-making entities, to determine what operations they perform on their information and resource inputs in order to produce their respective outputs. It is much easier to identify the alternative decision "rules" or criteria for the decision-making entities after their inputs and outputs have been specified over a range of typical conditions. For example, to determine the probable criteria used by a cabinet in making its political decisions, it helps to know what it decided to do in response to what kind of information and with what available resources in a number of situations. A decision analysis usually identifies the relatively stable criteria or motives of decision-making entities by dividing them into absolute values and instrumental values (those helpful in achieving the absolute values). Thus for King Charles in 1640, the royal prerogative was a stable absolute value pursued in all his decisions, while loyalty to his Lord Lieutenant, Strafford, was more of a negotiable instrumental value.

The decision analysis determines which "problems" are perceived in which way by the decision-making entities. "Problems" may be defined as discrepancies between the ideal state of the world perceived by the decision-making entity according to its values, and the perceived actual state. This problem recognition is followed by a problem-solving response, which may range from denial that the problem exists to the decision to allocate and engage various political, social, economic, or military resources to correct the discrepancy between ideal and reality. The criteria for recognition of a problem usually include its saliency for the decision-making entities' values. The criteria for the allocation and engagement of resources to correct problems usually include expectations of the relative cost, risk, and effectiveness of alternative responses.

In sum, the system analysis identifies the major actors in a process, their interactions, and their decision rules in responding to each others' actions.

Simulation Design: Given the model of decision-making entities, their inter-relations, and their individual decision rules developed by the system analysis, it remains to translate this

analytical model into a human player simulation or "game" which can communicate the results and implications of the analysis to the student. To communicate effectively with the student, the model must be translated into a social drama that involves the student's interest and enables him to experiment actively with the consequences of various "moves," or changes in the system under study. This remains the case whether the "system" is a psycho-social one, as in the conventional drama, a socio-political one as in most historical crises, or a socio-economic one as in most situations of technological innovation and social change.

The technique used to maximize student motivation for participating in the simulation, and thus learning the analytic model, is to turn it into a game. The game combines elements of dramatic conflict, curiosity over the outcome of uncertain events, and direct emotional expression through role playing. The game may be viewed as a dramatization of an analytic model of the situation to be studied, enacted by the students themselves in the roles of the decision-makers. To achieve an effective balance between analytical "truth" and dramatic communication, some degree of simplification is needed to form the basic "plot" of this sociodrama or game. Choices must be made about which subplots, characters, and events most lucidly dramatize the material to be conveyed. These choices will be influenced by the school situation constraints on time, space, student number and student capacity. Classroom time and student capacity for abstraction are the most common limiting factors.

The game teams, player objectives, allowable activities, win/lose criteria, and rules are then developed to achieve a maximum of learning in the participating student/player. The game design involves compromises or "tradeoffs" between the competing objectives of comprehensive realism vs. simplification for the sake of playability (a form of experimental manipulability). If a very comprehensive analytical model is simulated, it will either take many hours to play or, if played within a classroom hour, be very confusing to the student. On the other hand, if the model is greatly simplified, it may result in superficial student comprehension of the problem situation. The optimum degree of game detail from the aspect of "truth" and unlimited learning time conflicts with the optimum degree of student comprehension in the time available. This is no different from the conventional teaching problem. What does seem to be different in game learning is the greater informa-

tion-comprehending capacity of the student in an active role. Nevertheless, shorter games require more simplification and risk some distortion, exactly like shorter lectures.

Refinement: Once designed, educational games are refined by a series of test plays, in which various clumsinesses and distortions are identified and corrected. It is a form of repetitive "tuning."

In "tuning" the game parameters, various design tradeoff decisions must be made. (A "tradeoff" is a situation in which two or more characteristics interact competitively, and their optimum mix must be determined to assign them their relative weight in the process.) Some of the most important educational game design tradeoffs are listed below:

Realism (at the cost of ease of playing)	vs.	Simplification (at the cost of intellectual validity)
Concentration (at the cost of topical coverage)	vs.	Comprehensiveness (at the cost of detail and realism)
Melodramatic Motivation (at the cost of calm analysis)	vs.	Analytical "Calm" (at the cost of reduced emotional involvement and reduced motivation)

In deciding how to resolve these and other game design tradeoffs, it is necessary to remember that educational games must operate within fairly rigid temporal, spatial, and behavioral constraints. In educational games designed for secondary schools, it must usually be assumed that a given game must be played by from 20 to 30 students in one large room for a maximum of 50 minutes at a time, and that physical violence or loud outbursts must be avoided. (E.g., personal physical combat situations cannot be used even though they might be educational.)

There are equally important educational requirements that must be met by educational games with the available players, time, space, and behavior, *better* than by conventional teaching, to justify educational gaming. The design criterion for an educational game should be cost-effectiveness or educational efficiency superior to alternative techniques for the particular subject to be

taught. For example, if the history syllabus calls for a classroom hour to be devoted to the American Constitutional Convention, then a game can be justified only if it gives the students a deeper understanding of what happened than they can obtain from conventional teaching in that same hour, or if the game can put across an equally good understanding of the topic in less time. To the extent that educational games incur equipment expenditures, these must also be justified by correspondingly superior teaching effectiveness.

Examples of educational games

Educational games may be classified according to whether they emphasize skill, chance, reality, or fantasy; as well as according to whether they are strategic or showdown games.

In games of skill the outcome depends on the capabilities of the players, as in chess, tennis, or some types of business. Games of skill reward achievement, encourage individual responsibility and initiative, and discourage laziness. However, games of skill have the possible educational disadvantage of discouraging slow learners, dramatizing student inequalities, and feeding the conceit of the skillful.

In games of chance the outcome is independent of player capabilities, as in dice, roulette, and pure financial speculation. Games of chance have the educational advantages of dramatizing the limitations of effort and skill, humbling the overachievers and encouraging the underachievers. (It is no accident that they are the most popular types of games among slum populations, most of whom are probably underachievers.) On the other hand, games of chance minimize personal responsibility, effort, and skill, and may encourage magical thinking and passivity.

Games of reality are essentially models or simulations of nonplay, real world operations, as in the theater, fiction, military maneuvers, and such games as Monopoly and Diplomacy. They offer the greatest educational potential for student comprehension of structural relationships, the problems, motives, and methods of others, and for vicarious experiences of possibilities beyond the student's direct experience. Games of reality exploit the child's and adolescent's love of adult reality, achieving very high student motivation. A possible danger of reality games is the learning

of spurious analogies and an over-rating of the predictability of events.

Finally, games of fantasy which many persons would not call games at all, while admitting that they do involve play, release the player from conventional perceptions and inhibitions, as in dancing and skiing. There is emotional refreshment and stimulation of the imagination, but low cognitive content.

Most intentionally educational games are reality games of the strategic (rather than showdown) type. This is a matter of emphasis on the simulation of the reality to be learned, rather than the exclusion of skill, chance, and fantasy. With experience, reality games tend to become skill games as the players gain information through experimental manipulation of the game variables. The chance elements used to simulate detailed processes of uncertain or irrelevant mechanism in reality games also tend to become subject to skillful play, at least to the extent of statistical effectiveness.

The eight examples of educational games summarized below were designed for the Social Studies Curriculum Program of Educational Services Inc. by the author and his colleagues at Abt Associates Inc. during 1965. Most of them required the efforts of several designers from the social sciences, humanities, and scientific disciplines for one to three months for the design, and usually another three months for testing and refinement. Like the analytical models and works of dramatic history whose characteristics they share, they are never "finished" in the sense that no further improvements are possible, but they are all operable as educational games.

SEAL HUNTING and (Bushman) HUNTING have been played by elementary school children. EMPIRE, MANCHESTER, and ADVENTURING have been played by junior high school students. STEAM has been played by teachers and designers only. Only parts of REVOLUTION have been test-played thus far with junior high school students. GALAPAGOS has been test-played by designers and college undergraduates. (These games are all in the experimental stage, and have not yet been mass-produced for distribution.)

The empirical results thus far with SEAL HUNTING, HUNTING, EMPIRE, MANCHESTER, and ADVENTURING indicate very high student involvement in the game situations, and impressively rapid student comprehension of the educational con-

tent of the games. Just what percentage of improved educational efficiency is actually attained has not yet been determined by controlled experimental comparisons. However, the judgment of observing teachers, educators, and designers was generally most favorable.

1. *Game of SEAL HUNTING — Elementary School Level*

   —Netsilik Eskimo seal hunting on the winter ice; team of hunters and team of seals

   —Hunters arrange themselves at breathing holes and harpoon seals that come to breathe

   —Illustrates chance interaction of 2 independent worlds, seal and Eskimo, by use of a vertical game board which prevents communication between two teams

   —Students experience tension and excitement of seal hunting and participate in ritual meat sharing

   —One to two classroom hours

2. *Game of (Bushman) HUNTING — Elementary School Level*

   —Primitive Bushman ecology in Kalahari Desert

   —Entire class experiences simulated hunger, food consumption, search for prey in various habitats, for food, degrees of cooperation in hunting

   —Planting food supplies and stores, search for game, sharing of resources, differentiation of labor

   —Communicates much real material on primitive social organization, ecology

   —Can be used in other cultural contexts (Eskimo, etc.)

   —One to two classroom hours

3. *Game of EMPIRE — Junior High School Level*

   —Mercantile 18th Century British Empire

   —Entire class engages in trading, using goods, prices, tariffs, transport of 1730's

   —Competition, political influence, negotiation, smuggling, piracy, law enforcement

   —Seven interest groups aim to increase wealth (London Merchants, New England Merchants, Colonial Farmers, Southern

Planters, West Indies Planters, European Merchants, Royal Navy)

—Students experience London monopoly, arbitrary trade laws, risks of smuggling and piracy, protection and enforcement threats of Royal Navy

—Two to six classroom hours

4. *Game of ADVENTURING — Junior High School Level*

—Socio-economic status of yeoman, merchant, and gentry classes in England from 1600 to 1640, setting the stage of evolutionary social change and revolutionary political change

—Students play three generations of yeomen, merchants, and gentry men and women; make decisions on careers, locations, and wives constrained by class and finances; decide on loyalty to King or Parliament in Civil War and take the consequences

—Entire class engages in socio-economic competition for increased family social status, wealth, and numbers

—Students experiment with choice of 17th Century careers and adventuring in America, East Indies, etc., and note historically realistic consequences of their choices

—Four to five classroom hours

5. *Game of REVOLUTION — Junior High School Level*

—Role play simulation of decisive phases of the "Puritan Revolution" in England as precursor of the American Revolution

—Five phases of revolution in the English Civil War period (1628-1642); grievances; denial of redress; government incompetent in war, finance, and justice; conspiracy for revolt; and active revolution with dynamic leadership

—Students assume roles of lawyers and judges in Ship Money Case, Puritans debating response to religious persecution, Parliament debating control of the army and the Grand Remonstrance, Court and Parliament conspirators involved in the attempted arrest of the 5 members of Parliament, London and Oxford Parliaments deciding to go to war

—Students experience directly issues crucial for later American revolution: conflict between executive and legislature, religious toleration, taxation and representation, local vs. central government, trial by peers, control over armed forces

—Five classroom hours

6. *Game of STEAM — Senior High School Level*

—Economic application of steam engines to coal mining in 18th Century England

—Impact of economics on technological innovation in the early industrial revolution

—Entire class engages in simulation of smelting iron, buying and selling wood and coal for smelting, innovating steam pumps to pump seepage out of coal mines

—Teams of iron mill owners, land owners, coal-mine operators, technological innovators

—Students experience problems of deciding on technological innovation under competitive market pressures

—Two to three classroom hours

7. *Game of MANCHESTER — Senior High School Level*

—Movement of farming populations to urban industry in Manchester circa 1780-1800 (Industrial Revolution)

—Students engaged in simulated farming, buying and selling of farm and mill labor, cloth manufacture by cottage industries and urban factories, labor in urban poorhouses

—Competition among mill owners, land owners, freeholders, tenant farmers, and laborers

—Students experience economic pressures of common land enclosures, rising factory wages, fluctuations in textile market, land and factory productivity changes

—One to two classroom hours

8. *Game of GALAPAGOS — Senior High School Level*

—Evolution of finches on the Galapagos Islands

—Three or four teams of observers watch the simulated evolution and predict survival, structural formation, and origin of new species

—Allows exercise of scientific observation, prediction and evaluation to form a theory of speciation for the Galapagos finches

—Demonstrates effects of inter- and intra-species competition, isolation, convergent evolution, ecological and geological change and sequencing of adaptive variations

—Links Darwin's archaeological and geological data to the theory of natural selection and the methodology of interpretation

—Two to three classroom hours or as special project

Advantages and limitations of educational games

Self-directed learning in games occurs in three, usually successive, phases as a result of active participation and intense involvement of the student:

I — Learning *facts* expressed in the game context and dynamics
II — Learning *processes* simulated by the game
III — Learning the relative costs and benefits, risks and potential rewards of *alternative strategies* of decision-making

Because these three levels of game learning can occur simultaneously in multi-player teams, individual games accommodate a very broad range of student ages and achievement levels. (For example, reading levels ranging from grade 4 to grade 9 have successfully played in the same game of ADVENTURING.) The slower students also learn from the faster ones, sometimes better than from teachers. Both slow and rapid learners can share social interactions in the game while learning from it at quite different levels. Culturally deprived students respond relatively better to game teaching than to less dynamic, more expository methods. For this and other reasons, games may be able to test the comprehension and solution of complex problems better than purely verbal tests, as well as offering highly motivated self-directed learning.

To summarize, the games method of education at its best includes the following characteristics: A combination of the systems sciences and the dramatic arts—the systems approach for analysis, drama for involvement and motivation. Emphasis is placed on developing analytic approaches and organizing concepts transferable to other problems identified by the students themselves. Intuitive thinking is encouraged, as well as analysis by use of analogy, testing of limiting conditions, and visual expression of solutions. Learning is made entertaining and relevant to the student's life experiences. There is no "talking down" to students—realistic, adult materials are used. Learning is achieved by exploratory problem-solving simulations (games) involving role play, with self-directed student participation. Communications and negotiations skills are developed by team activities. A cross-disciplinary, concrete experiential view of problems is expressed dramatically and abstraction capabilities are built on multiple sensory experiences.

Educational games use the *student's* way of viewing things. They present *concrete* problems in a simplified but dramatic form that mediates between abstraction and confusion, between dry theory and multi-variable reality. For *elementary* school children, educational games translate the child's primarily concrete, intuitive thinking into a sequence of dramatized possibilities that expands his awareness of hypothetical alternatives and fundamental relations. The child deeply involved in the concrete activity of educational gaming becomes aware of formal relationships by direct experimental manipulation. Pleasurable rewards for manipulating formal relationships effectively are fed back immediately in the form of game success. Elementary school children tend to focus on only one aspect of a phenomenon at a time, greatly limiting their ability to comprehend phenomena with even a few interactions among elements. Games present simultaneously progressing multiple interactions that can first be examined one at a time, and then gradually together with increasing comprehensibility.

Educational games often use probabilistic mechanisms to simulate subordinate causal sequences too complex or uncertainly understood to be replicated directly. The natural interest of the children playing the games in these decisive probabilistic mechanisms leads to their learning to understand simple probability from a series of direct experiences. Awareness of probability, together with game pressures to make decisions under conditions of uncertainty, leads children to develop logical strategies taking account of both probabilities and costs. This is the essence of modern statistical decision theory and cost-effectiveness analysis. Elementary school children can learn it by playing games.

The attention span of elementary school children is stretched by educational games. Games generate potent motivation due to the expectation of pleasure children associate with them, and because of their inherent dramatic interest deriving from action, conflict, and uncertainty of outcome. Sustaining motivation is provided by the responses of the other players in the game to the actions of the student player. The student feels himself a cause of events, rather than a merely passive spectator.

The student player gains a growing sense of structure among the game variables, with a correspondingly growing sense of structure of the subject simulated by the game. This can expand the student's attention span and intellectual confidence. The more

densely packed a game is with such structure (up to a surprisingly high degree of apparent confusion), the longer the learning episode that can be tolerated by the student without fatigue or loss of interest. The longer and more concentrated the learning episode, the greater the student's understanding and confidence in the intellectual satisfactions of subsequent episodes.

One of the main problems for *secondary school* students is their sense of the relevance of what they are learning to their future expectations. Motivation must be sustained beyond the transient rewards of grades and college admission. Students must believe, and believe correctly, that what they learn will be important to them as adults. "Importance" should be defined broadly, to include not only useful career guidance and training, but also a sense of meaningful identity and the appreciation of general intellectual and social values. Students should have reason to believe that what they learn will help them to understand, predict, and control to a socially acceptable degree their own future environment, as well as their own actions in it.

Educational games that simulate reality can present the great problems of contemporary society on a level of specific human action that directly relates the student's decisions to the larger world. The relevance of educational games perceived by students is both substantive and methodological. Games dealing with economic, political, social, and scientific problems on the adult scale are of obvious substantive relevance to the student's future adult activities. But educational games and simulations also encourage the student to make systematic rational cost-benefit calculations in the face of uncertainty, and use intuitive heuristics.

Educational games incorporate the human aspects of analytic problem-solving. In conventional school situations, the solution to problems is taught on an abstract, impersonal basis. This neglects the interpersonal aspects of most of the decision problems faced by adults. In educational games, a player needs not only to calculate his best moves, but he also needs to persuade his teammates of the effectiveness of these moves. Student players learn loyalty and the decent limits of rivalry. The compressed competitive experience gives students a realistic foretaste of the nature of competition and negotiation, where technical success can be spoiled by social neglect or greed. Over-aggressive, uncontrolled, or apathetic behavior is punished in a non-fatal way

in games, disciplining and institutionalizing behavior through peer interactions. The intellectual and the social skills needed to solve adult socio-economic problems are developed in concert in educational games, as they must be applied in concert in adult life.

The clearest advantage of educational gaming is increased student motivation. Particularly where student motivation may be very low because of socio-cultural factors, and where students find much of their curriculum irrelevant to their own life experiences, educational games can make previously uninteresting material fascinating. Although conclusions would be premature, we have noticed a certain differentially greater improvement in the poorest students when learning with games. Students with culturally impoverished home backgrounds seem to be at less of a disadvantage in educational games than they are in conventional classroom situations. The poorest children can play games, and play them well.

A yet unmeasured advantage of educational games, and one that may not exist for all social studies, is the greater understanding of the relationships in integrated historical processes that they provide. It is one thing for a student to learn some facts of mercantilism, and quite a further step for him to grasp the forces that caused its development, determined its successes and failures, and led to its decline.

Teachers implementing the educational games of EMPIRE and HUNTING have commented that they are "very exciting" and, unlike any other techniques, involve almost 100% of the students. They believe that a great deal of learning occurs, but that the best use of such games is in conjunction with background reading before the games and class discussion afterwards. In short, most feel that the most effective use of educational games is achieved by a considerably less than total allocation of classroom time to gaming.

Some of the principal limitations on the effectiveness of educational games are the attitudes that teachers have about them. A frank discussion of these attitudes is not intended as a criticism of teachers, who generally are intelligent and hard-working.

Some teachers feel that games are not "serious," or that students will not take them sufficiently seriously, thus possibly dissipating student concentration on the topic being taught. Our experience has been quite the contrary, with students becoming

utterly absorbed in the game situations. The games seem to be an excellent means of sharpening concentration.

A possibly more permanent problem is the attitude some teachers have toward complexity in games. Almost all the students we have observed have been impatient to begin playing the educational games, while the rules were being patiently and repeatedly explained by the teacher. The students are quite accustomed to plunging into situations of which their understanding is uncertain or incomplete. The teachers, on the other hand, often feel constrained to understand the rules completely before they will permit the game to begin. This may be a natural extension of a teacher's felt need to maintain control of classroom behavior, and is certainly a useful and necessary attitude in conventional situations. However, in an educational game situation, a more permissive attitude may be more fruitful, wasting less time and avoiding the dissipation of student interest.

Educational games of considerable complexity can be designed so that only very simple rules must be understood to begin playing. The students may then discover additional rules and complexities in the course of the game.

A few teachers distrust educational games because they doubt their intellectual validity, or historical verisimilitude. They ask, for example, how an historical game can be truthful and valid if its outcome is uncertain, or differs from actual history. This objection is based on a misunderstanding of game objectives. It must always be clearly explained to both teachers and students that educational games are not intended exactly to reproduce some series of historical events. If they did, they would not be games, because there would be no element of uncertainty, curiosity, and surprise about the outcome. The object of the game is to involve the student in the *types* of situations, motives, practical constraints, and decisions that are the subject of study, not the specific details. The student should emerge from the game with a better understanding of what it was all about, what was possible and what was not, and why. Of course, students could deduce incorrect conclusions from a too small number of game experiences, just as they could deduce incorrect conclusions from too small a number of case studies, or from too few lectures on a subject.

A possible and readily avoidable disadvantage of educational games arises when the above misunderstanding becomes a self-

fulfilling prophecy. If the only exposure of students to an historical situation is a game, and the game outcome differs from history, then obviously the student will have learned some wrong things for whatever right reasons. This risk is readily avoided by preparatory teaching of the general aspects of the game situation, and post-game comparison and discussion of game "simulated" history and actual history.

A more serious limitation of educational games is their very attractiveness to students. It must be recognized that educational games are not a substitute for, but only an enhancing complement of, conventional study methods. Background information must still be carefully studied. Integrative syntheses and evaluative judgments must still be worked out and clearly expressed in recitation and writing. Furthermore, educational games are impractical or inappropriate for teaching some topics, as well as not especially helpful in developing some intellectual skills. Yet there is the danger that a poorly disciplined class of students will find educational material not in games relatively boring. This limitation can be overcome by carefully relating gamed and nongamed material, so that the games are only the integrative culminations of a series of educational steps involving reading, writing, and discussing.

If the students' given initial capabilities and resources in educational games were determined by their performance on examination on background material, then they might be all the more motivated to do their conventional studies. In this sense educational games may enhance the effectiveness of conventional study exercises in which they are embedded.